REMARKS

Claims 1, 9, 11, 16, 26, 31, and 33 are amended, and claims 71-73 are added; as a result, claims 1-40, and 71-73 are pending in this application.

§112 Rejection of the Claims

Claims 8 was rejected under 35 U.S.C. § 112, second paragraph, for indefiniteness. The Applicant respectfully traverses the rejection.

The Office Action held: "An isolation structure would never be considered part of an access device, therefore it is unclear what is meant by having an access device that is free from a shallow trench." Applicant disagree because an access device may include a shallow trench isolation layer as is often the case. Support for the claim is found in the application on pg. 3, lines 2-3; pg. 21, lines 23-25; and in the abstract on lines 6-7. The claim is therefore definite. Withdrawal of the rejection is respectfully requested.

Claim Objections

Claims 11, 16 and 26 were objected to for informalities. Claims 11, 16, and 26 have been amended to overcome the objections. Withdrawal of the rejection is respectfully requested.

§102 Rejection of the Claims

Claims 1-4, 8-11, 13-18, 20 and 25-27 were rejected under 35 U.S.C. § 102(b) for anticipation by Fitch et al. (U.S. 5,451,538).

Claims 1-4, 8-20 and 24-27 were rejected under 35 U.S.C. § 102(b) for anticipation by Bissey et al. (U.S. 6,794,699).

Claims 31-37 were rejected under 35 U.S.C. § 102(b) for anticipation by Augusto (U.S. 5,963,800).

Applicant respectfully traverses the Examiner's §102 - based rejection.

1. *Regarding Claim 1-4, 8-11, 13-18, 20, and 25-27*:

Fitch et al disclose in Fig. 10 a channel region 30 formed of a first conductivity type, a dielectric layer 22 that is a gate oxide, and a conductive layer 18, wherein the doping in the

channel region 30 can be used to adjust the threshold voltages. (col. 4, lines 61-66). Therefore, Fitch et al disclose a vertical FET device where conductive layer 18 is a gate electrode, dielectric layer 22 is the gate dielectric, and channel region 30 between gates 22 are inversion channels for controlling current flow between drain electrode 28 (of a second conductivity type opposite the first conductivity type) (col. 4, line 42-45) and source electrode 32/34 (col. 5, line 9 and 29-30). Because dielectric layers 22 are insulators, there is no current flow between conductive layers 18 and channel region 30. Further, because conductive layer 18 is enclosed by dielectric layer 16 (col. 3, line 39), gate dielectric 22, and conductive layer 20 (col. 3, lines 32-33), there is no current flow into the epitaxial region (Fig. 10, Refs. 28, 30, 32, 34) through conductive layer 18. Therefore, the epitaxial region disclosed by Fitch et al is not part of conductive layer 18.

With Respect to Claim 1:

In contrast Applicant's claim 1 recites, in part, "wherein the selective epitaxy mesa comprises a portion of a buried conductive path." Applicant can find no such teaching in the Fitch disclosure.

With Respect to Claims 2-4, and 8:

Applicant's claims 2-4, and 8 depend either directly or indirectly on claim 1 and incorporate all its elements. Applicant believes base claim 1 is allowable, and therefore, claims 2-4, and 8 are also allowable.

With Respect to Claim 9:

In contrast Applicant's claim 9 recites, in part, "wherein the selective epitaxy mesa comprises a portion of a buried conductive path." Applicant can find no such teaching in the Fitch disclosure.

With Respect to Claims 10-11, and 13-15:

Applicant's claims 10-11, and 13-15 depend either directly or indirectly on claim 9 and incorporate all its elements. Applicant believes base claim 9 is allowable, and therefore, claims 10-11, and 13-15 are also allowable.

With Respect to Claim 16:

In contrast Applicant's claim 16 recites, in part, "wherein a portion of the selective epitaxy mesa comprises a conductive portion of the electrical signal line." Applicant can find no such teaching in the Fitch disclosure.

With Respect to Claims 17-18, 20, and 25:

Applicant's claims 17-18, 20, and 25 depend either directly or indirectly on claim 16 and incorporate all its elements. Applicant believes base claim 16 is allowable, and therefore, claims 17-18, 20, and 25 are also allowable.

With Respect to Claim 26:

In contrast Applicant's claim 26 recites, in part, "wherein a portion of the selective epitaxy mesa comprises a conductive portion of the electrical signal line." Applicant can find no such teaching in the Fitch disclosure.

With Respect to Claim 27:

Applicant's claim 27 depends on claim 26 and incorporates all its elements. Applicant believes base claim 26 is allowable, and therefore, claim 27 is also allowable.

2. *Regarding Claims 1-4, 8-20, and 24-27:*

The Office Action held that "selective epitaxy does not structurally distinguish the claimed invention over Bissey", because "[a]n epitaxy layer is merely a layer that mimics the crystal orientation of the substrate." Applicant respectfully disagrees with the conclusion because a mesa is a distinguishing structural feature. In fact, a mesa is among the most important features comprising any epitaxial device structure.

The fact that two structures may have identical crystal symmetry is not dispositive of device structure because device structure is not determined solely by crystal orientation. In fact, crystal symmetry does not inherently determine all structural properties. For example, the electrical and optical properties as well as mechanical properties such as defect type, formation,

and propagation can differ markedly between epitaxial and non-epitaxial materials. Defect population alone significantly alter the acoustic and optical phonon densities that govern radiative and non-radiative recombination processes; such processes determine carrier mobility, and ultimately, device operating speed and frequency. The maximum dopant concentration that can be incorporated without adversely affecting device characteristics differs between processes due to growth temperature differences.

Bissey et al disclose silicon pillars 33 that form the channels of the FETs 14, that are produced by subtractively etching a P-doped silicon substrate 32. (col. 3, line 65 - col. 4, line 3) Therefore, Bissey et al disclose a structure formed only as a single crystal silicon structure with uniform crystal orientation. Further, the structural properties disclosed by Bissey is dependent solely on the substrate crystal structure because the channel is necessarily formed of the same substrate material. In contrast, an epitaxial mesa is not limited to mimicking the substrate orientation.

Bissey also teach an N+ contact region (Fig. 4, Ref. 38) formed by "out-diffusion", gas diffusion or ion implantation techniques. (col. 4, lines 55-58). The out-diffusion region is formed by over doping the polysilicon layer (Ref. 36) to diffuse dopant into the N+ contact region from the polysilicon when heated. (col. 4, lines 48-52) Dopant diffusion necessarily creates a gradient of dopant atoms in both the N+ region and the polysilicon layer proximate the N+ region. Dopant distribution profile and diffusion depth are natural consequences determined by process temperature. Further, the N+ contact region (Ref. 38) must also include P-type dopant atoms (from the P-doped silicon, see col. 3, lines 65-66). The resulting p-n junction then is graded in the region comprising the N+ contact region and pillar (Ref. 33), which reduces the ideality factor in the exponent of the junction diode equation that governs the junction current. Electric field and depletion width are also directly and significantly determined by dopant gradient, which in turn defines the junction capacitance. The ability to control dopant gradient, including no gradient, is a key advantage and a prime reason for using an epitaxial mesa.

Finally (not intended as a limitation), because the N+ region disclosed by Bissey is compensated (i.e., includes N-type and P-type dopant atoms), the mobility is less and the resistance is higher throughout that region. Resistance controls structural heating and also the RC time constant impacting device operating/switching speed. Bissey et al do not teach for

example, a pillar structure with crystal orientation different than the substrate, or a teach a pillar with a contact region (Ref. 38) containing essentially only one carrier type, or gradient-free contact and polysilicon regions (Ref. 32).

With Respect to Claim 1:

In contrast Applicant's claim 1 recites, in part, "wherein a region of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type." Applicant can find no such teaching in the Bissey disclosure.

With Respect to Claims 2-4, and 8:

Applicant's claims 2-4, and 8 depend either directly or indirectly on claim 1 and incorporate all its elements. Applicant believes base claim 1 is allowable, and therefore, claims 2-4, and 8 are also allowable.

With Respect to Claim 9:

In contrast Applicant's claim 9 recites, in part, "wherein a region of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type." Applicant can find no such teaching in the Bissey disclosure.

With Respect to Claims 10-15:

Applicant's claims 10-15 depend either directly or indirectly on claim 9 and incorporate all its elements. Applicant believes base claim 9 is allowable, and therefore, claims 10-15 are also allowable.

With Respect to Claim 16:

In contrast Applicant's claim 16 recites, in part, "wherein a region of the selective epitaxy mesa adjacent to the electrical signal line includes a lateral non-graded dopant profile consisting

essentially of dopant atoms of one conductivity type." Applicant can find no such teaching in the Bissey disclosure.

With Respect to Claims 17- 25:

Applicant's claims 17-25 depend either directly or indirectly on claim 16 and incorporate all its elements. Applicant believes base claim 16 is allowable, and therefore, claims 17- 25 are also allowable.

With Respect to Claim 26:

In contrast Applicant's claim 26 recites, in part, "wherein a region of the selective epitaxy mesa adjacent to the electrical signal line includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type." Applicant can find no such teaching in the Bissey disclosure.

With Respect to Claim 27:

Applicant's claim 27 depends directly on claim 26 and incorporates all its elements. Applicant believes base claim 26 is allowable, and therefore, claim 27 is also allowable.

3. *Regarding Claim 31-37*:

Augusto et al disclose a vertical channel FET structure (col. 10, lines 13-15), wherein the bit line conductor (as disclosed in Fig. 10.1) is formed on an undoped substrate and entirely underneath the vertical channel FET (Figs. 7.1- 10.3). The vertical channel FET structure does not comprise a vertical portion of the bit line conductor. (see also Fig. 2a and 2b as referenced by col. 10, lines 13-20)

With respect to Claim 31:

In contrast Applicant's claim 31 recites, in part, "a portion of the selective epitaxy body is adapted to comprise a vertical portion of a buried bit line, wherein a region of the selective epitaxy body adjacent to the vertical portion includes a laterally non-graded dopant profile

consisting essentially of dopant of one conductivity type." Applicant can find no such teaching in the Augusto disclosure.

With Respect to Claims 32- 37:

Applicant's claims 32-37 depend directly on claim 31 and incorporate all its elements. Applicant believes base claim 31 is allowable, and therefore, claims 32-37 are also allowable.

§103 Rejection of the Claims

Claim 30 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Fitch et al. in view of Kurjanowicz et al. (U.S. Publication No. 2002/0131291).

Claims 38-40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Augusto in view of Fitch.

Applicant respectfully traverses the § 103-based rejection. An obviousness-type rejection under § 103 requires the references must teach or suggest all the claim elements when combined. M.P.E.P. § 2142 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991)).

4. *Regarding Claim 30:*

The Office Action has admitted that neither Fitch et al nor Kurjanowicz et al teach all elements of Applicant's claim 30, but rather the Office Action relies on Kurjanowicz et al in combination with Fitch et al. Applicant recites the above § 102 (b) discussion pertaining to Fitch et al with respect to Applicant's claim 26.

Kurjanowicz et al teach a folded bit line architecture for connecting memory cells. Kurjanowicz primarily disclose surface topography. Applicant is unable to find the requisite three-dimensional structure in Kurjanowicz et al.

In contrast Applicant's claim 26 recites, in part, "wherein a portion of the selective epitaxy mesa comprises a conductive portion of the electrical signal line, and wherein a region of the selective epitaxy mesa adjacent to the electrical signal line includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type." Applicant is unable to find any such teaching in the Kurjanowicz disclosure. Therefore, the Fitch and Kurjanowicz disclosures, either alone or in combination, do not teach each and every element of Applicant's

claim 26. Because claim 30 is dependent directly on claim 26 and incorporate all its elements, Applicant's claim 30 is distinct from and non-obvious with respect to Fitch et al and Kurjanowicz et al.

5. *Regarding Claim 38-40:*

The Office Action has admitted that neither Fitch et al nor Agusto et al teach all elements of Applicant's claim 31. Claims 38-40 are dependent either directly or indirectly on claim 31 and incorporate all its elements. Therefore Applicant's claims 38-40 are distinct from and non-obvious with respect to Fitch et al and Agusto et al.

The Office Action held "[n]ote that it considered the gate is only the portion of layer 18 that is in the immediate vicinity of the channel (therefore having an annular structure) it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Agusto by using the cylinder configuration of Fitch for the purpose of obtaining a maximum amount of current carrying capability." Applicant traverses the conclusion. Applicant is further unable to understand the relevancy of the comment with respect to Applicant's claims 38-40 and requests clarification.

Response To Restriction Requirement

Applicant reasserts the September 21, 2005 response to the Examiner's request for restriction. In response to the Election of Species Requirement mailed June 21, 2005, Applicant elected Species I, having at least claims 1-4, 8-16, 19-20, 22, 26, 27, and 30-40 readable thereon. Applicant agreed with the Examiner that claims 1, 9, 16, 26, and 31 are generic. Moreover, claims 2-4, 8-11, 16, 26, 30-36, 38 and 40 are also believed to be generic to all species. Applicant requests examination of all other species upon allowance of a generic claim. Applicant respectfully reserves the right to reintroduce the non-elected claims for reconsideration in this application upon the allowance of a linking claim or to reintroduce them in one or more divisional applications at a later date.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

TERRENCE C. LESLIE

By his Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9587

Date 14 Feb '06

By _____
Timothy B Clise
Reg. No. 40,957

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 14 day of February, 2006.

KATE GAWRON
Name

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Signature